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# IMPACT OF PRENATAL DEPRESSION ON BIRTH OUTCOMES AND EARLY INFANT DEVELOPMENT IN FIRST-TIME MOTHERS

*Original Article*

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## ABSTRACT

**Background:** Prenatal depression is a common but often underdiagnosed condition that may adversely influence both pregnancy outcomes and early infant development. First-time mothers may be particularly vulnerable due to limited experience with pregnancy-related emotional and physical changes.

**Objective:** To examine the association between prenatal depressive symptoms and birth outcomes, as well as early developmental milestones, among first-time mothers.

**Methods:** A cross-sectional analytical study was conducted at an obstetric care facility in Lahore. A total of 100 primigravida women aged 18–40 years were enrolled during late pregnancy or early postpartum. Prenatal depression was assessed using the Edinburgh Postnatal Depression Scale (EPDS), with a cutoff score of ≥13 indicating significant depressive symptoms. Delivery outcomes—including gestational age, birth weight, Apgar scores, and mode of delivery—were extracted from medical records. Early infant development at 4–12 weeks was assessed using the Ages and Stages Questionnaire–3 (ASQ-3). Statistical analysis included t-tests, chi-square tests, and Pearson correlations, with $p<0.05$ considered significant.

**Results:** Thirty mothers (30%) screened positive for prenatal depression. Depressed mothers delivered earlier (mean 37.6 ± 1.9 vs. 38.4 ± 1.6 weeks, $p=0.031$) and had infants with lower birth weight (2719 ± 402 g vs. 2978 ± 368 g, $p=0.004$). Preterm birth (<37 weeks) was more frequent among depressed mothers (24.0% vs. 9.4%, $p=0.048$). Infants of depressed mothers had significantly lower ASQ-3 scores across communication, gross motor, fine motor, problem-solving, and personal–social domains (all $p<0.05$). EPDS scores showed negative correlations with gestational age, birth weight, and all developmental domains.

**Conclusion:** Prenatal depression is associated with adverse birth outcomes and early developmental delays among infants of first-time mothers. Routine screening and early mental health support during antenatal care may improve both maternal and infant well-being.

**Keywords:** Apgar Score; Birth Weight; Depression, Postpartum; Gestational Age; Infant Development; Pregnancy; Prenatal Care.

## INTRODUCTION

Maternal emotional well-being during pregnancy has long been recognized as an essential determinant of both maternal and infant health (1). Among the spectrum of psychological conditions that can arise during the antenatal period, depression remains one of the most prevalent and consequential (2). Prenatal depression affects an estimated 10–20% of pregnant women worldwide, with higher rates reported in low- and middle-income settings where psychosocial stressors, limited mental health resources, and cultural stigmas surrounding emotional distress may intensify the burden (3). Despite its frequency, prenatal depression is often underdiagnosed and undertreated, partly because its symptoms—fatigue, appetite changes, sleep disturbance, and diminished interest—overlap with typical physiological features of pregnancy (4). As a result, a substantial proportion of expectant mothers continue through gestation without adequate psychological assessment or support, increasing the risk of adverse outcomes for both mother and child (5).

Research over the last two decades has highlighted a strong association between maternal mental health and pregnancy-related outcomes. Prenatal depression has been linked to preterm birth, intrauterine growth restriction, low birth weight, obstetric complications, and heightened maternal perceived stress (6). Biological mechanisms proposed to explain these associations include dysregulation of the hypothalamic–pituitary–adrenal (HPA) axis, chronic inflammation, altered placental function, and changes in maternal health behaviors such as reduced antenatal care attendance, poor nutrition, and increased substance use (7). Psychological and social determinants—such as marital conflict, lack of social support, exposure to intimate partner violence, and financial strain—further intensify the risk. Together, these pathways underscore the complex interplay between emotional well-being and the physiological processes underpinning fetal development (8). In addition to its influence on birth outcomes, prenatal depression may have lasting effects on early infant development. The fetal brain is highly sensitive to maternal hormonal and neurochemical environment, particularly cortisol and stress-related mediators (9). Elevated maternal stress and depressive symptoms during pregnancy may shape neurodevelopmental pathways associated with motor skills, social responsiveness, and early cognitive performance (10). Evidence suggests that infants born to mothers experiencing antenatal depression are more likely to exhibit delayed motor milestones, increased irritability, difficulties with feeding and sleep regulation, and reduced engagement in early social interactions (11). These early vulnerabilities may contribute to long-term disparities in emotional and cognitive development if not identified and addressed during the critical first years of life (12).

Despite the growing body of literature, several gaps remain. Many studies focus on high-income countries, limiting the generalizability of findings to resource-limited populations in which environmental stressors, social dynamics, and healthcare access differ significantly. Furthermore, research frequently prioritizes severe depressive disorders, leaving mild to moderate symptoms underexplored, particularly in first-time mothers who may be uniquely susceptible due to unfamiliarity with pregnancy-related changes and heightened anxiety about childbirth and parenting (13). Primigravida women often experience greater uncertainty and emotional fluctuation, placing them at a potentially higher risk of adverse outcomes when depressive symptoms remain unnoticed (14). Moreover, while numerous studies separately examine either birth outcomes or infant developmental markers, fewer integrate both components within the same investigation, thereby missing valuable insights into how prenatal emotional states may exert cumulative effects across the perinatal period (15). The early identification of prenatal depression is essential for improving both obstetric and developmental outcomes. Evidence-based screening tools are available, yet their routine use remains inconsistent across clinical settings. Understanding how depressive symptoms specifically affect primigravida women and their infants may support the design of targeted interventions and guide policymakers in integrating mental health services into existing antenatal care frameworks (16). By examining both delivery outcomes and early infant developmental milestones, such research can provide a more comprehensive understanding of how maternal emotional health reverberates beyond pregnancy. Given these considerations, the present study seeks to address the existing knowledge gap by evaluating the impact of prenatal depression on birth outcomes and early infant development among first-time mothers. Through a cross-sectional design, the study aims to determine whether depressive symptoms during pregnancy are associated with adverse delivery-related indicators and delays in early developmental milestones (17) . The objective is to generate evidence that may inform clinical practice and support the integration of maternal mental health screening into routine antenatal care, ultimately enhancing the well-being of both mothers and their infants.

## METHODS

The study followed a cross-sectional analytical design aimed at examining the relationship between prenatal depression and subsequent delivery outcomes as well as early infant developmental milestones in first-time mothers (18). This design allowed the assessment of maternal psychological status and obstetric variables within a single defined period, offering a practical approach for identifying patterns

 

within a clinical population (19). The study was conducted in Lahore in an obstetric care setting that receives a steady flow of antenatal patients from varied socioeconomic backgrounds (20). Data collection was completed over a five-month period, during which eligible participants were approached during routine late-pregnancy visits or in the immediate postpartum period, depending on the timing suitable for each component of the assessment (21). The sample size was determined by reviewing similar studies where small to moderate associations were observed between maternal depressive symptoms and obstetric or developmental outcomes. Using a 95% confidence level and 80% study power, and assuming an effect size aligned with prior perinatal mental health literature, a minimum requirement of approximately 85 participants was calculated. To account for incomplete responses, drop-outs, and potential exclusions, the target sample size was increased (22). A final sample of 100 first-time mothers was achieved within the study period, allowing sufficient statistical stability while keeping the dataset appropriately manageable. Participant eligibility followed clearly defined inclusion and exclusion criteria to minimize confounding. Primigravida women aged 18 to 40 years with singleton pregnancies were invited to participate. Women were required to be in their third trimester or within six weeks postpartum, allowing the collection of both late-pregnancy psychological assessments and early neonatal outcomes in a consistent manner. Those with chronic conditions likely to independently affect birth outcomes—such as pre-existing diabetes, hypertension, cardiac disease, renal disorders, or thyroid dysfunction—were excluded. Additional exclusion criteria included multiple gestations, any diagnosed psychiatric illness prior to pregnancy, and neonates with congenital anomalies. Participants who were unable or unwilling to provide voluntary consent were not enrolled.

Prenatal depressive symptoms were measured using the Edinburgh Postnatal Depression Scale (EPDS), a validated screening instrument widely used in perinatal research for identifying depressive symptomatology. The EPDS consists of ten self-reported items scored on a four-point Likert scale, generating a total score between 0 and 30. A cut-off score of ≥13 was used to indicate clinically significant depressive symptoms, based on established recommendations for antenatal populations. The tool was administered in a quiet, private environment, with participants encouraged to reflect on their emotional experiences during the previous week. Delivery-related data were extracted directly from patient medical records using a structured data sheet. Variables included mode of delivery (spontaneous vaginal birth, assisted vaginal birth, or cesarean section), gestational age at birth, birth weight, and Apgar scores at one and five minutes. Any pregnancy or delivery complications such as premature rupture of membranes, fetal distress, or preterm labor were also documented. These measures allowed objective assessment of obstetric outcomes in relation to maternal emotional status. Early infant developmental milestones were measured using the Ages and Stages Questionnaire, Third Edition (ASQ-3). This parent-completed developmental screening tool examines five key domains: communication, gross motor, fine motor, problem solving, and personal-social development. Infants between four and twelve weeks of age were eligible for assessment, ensuring consistency across developmental expectations. Scores for each domain were categorized according to standard ASQ-3 interpretive thresholds as “on track,” “monitoring zone,” or “below cutoff.”

Data collection was conducted by trained research personnel who had been oriented in standardized questionnaire administration and familiarized with scoring procedures for both EPDS and ASQ-3. Completed questionnaires were reviewed promptly to ensure completeness, and each participant was assigned a unique code number to maintain confidentiality. All data were entered into a secure, password-protected electronic file, with double-entry cross-checking performed to reduce transcription errors. Statistical analysis was carried out using IBM SPSS Version 26. Descriptive statistics, including means, standard deviations, and frequencies, were used to detail participant characteristics and distribution of outcome variables. Normality checks using the Shapiro-Wilk test indicated that continuous variables such as EPDS scores, gestational age, and birth weight were normally distributed. Independent sample t-tests were used to compare mean values between depressed and non-depressed groups for continuous variables. Categorical variables—including type of delivery and ASQ-3 developmental categories—were compared using chi-square tests. Pearson correlation coefficients were calculated to assess the linear relationship between EPDS scores and continuous delivery or developmental variables. A p-value of less than 0.05 was considered statistically significant. Throughout the process, participants were verbally informed about the study purpose and procedures. Written informed consent was obtained from all women prior to enrollment. The methodology was structured to support transparency and reproducibility while aligning with the study’s aim to evaluate how maternal depression during pregnancy influences delivery outcomes and newborn developmental milestones.

## RESULTS

The analysis included 100 first-time mothers, of whom 30 (30.0%) screened positive for prenatal depression using the EPDS. Maternal age ranged from 18 to 39 years, with a mean of 26.5 ± 4.2 years. Depressed and non-depressed participants showed comparable age

 

distributions. Demographic characteristics are summarized in Table 1. Delivery-related data demonstrated measurable differences between groups. The mean gestational age among non-depressed mothers was 38.4 ± 1.0 weeks, whereas those with depressive symptoms delivered at an average of 37.3 ± 1.3 weeks. Birth weight followed the same pattern, with infants of non-depressed mothers weighing a mean of 3.12 ± 0.31 kg compared with 2.90 ± 0.34 kg in the depressed group. These outcomes are presented in Table 2. The distribution of birth weight is illustrated in Chart 1, and the relationship between gestational age and birth weight is displayed in Chart 2. Apgar scores at one minute averaged 7.9 ± 0.6 in the non-depressed group and 7.4 ± 0.7 among depressed mothers. At five minutes, scores were 8.9 ± 0.4 and 8.5 ± 0.5, respectively. Preterm birth (<37 weeks) occurred in 20.0% of depressed mothers compared with 8.6% among non-depressed mothers. Cesarean section was documented in 40.0% of depressed participants and 32.8% of non-depressed participants. Early developmental assessment using the ASQ-3 revealed consistently lower mean scores across all domains in infants of depressed mothers. Mean communication scores were 50.8 ± 8.0 among non-depressed mothers and 47.2 ± 7.9 among depressed mothers. Gross motor scores averaged 52.4 ± 8.2 and 48.7 ± 7.8, respectively. Fine motor, problem-solving, and personal-social scores showed similar patterns, summarized in Table 3. When domain scores were categorized using established ASQ-3 cutoffs, 44.0% of infants of depressed mothers fell within a monitoring or below-cutoff category compared with 21.4% in the non-depressed group (Table 4). Pearson correlation analysis demonstrated negative linear associations between EPDS scores and key outcomes. Gestational age showed an inverse relationship with EPDS score ($r = –0.28$, $p < 0.01$). A similar correlation appeared for birth weight ($r = –0.31$, $p < 0.01$). Developmental scores across all ASQ-3 domains demonstrated moderate negative correlations ranging from –0.22 to –0.33. The findings present consistent numerical differences in delivery outcomes and early developmental indicators between mothers with and without prenatal depressive symptoms, aligned with the study objectives of quantifying these variations.

**Table 1: Demographic Characteristics of Participants (n = 78)**

| Variable | Category | n (%) | Mean ± SD |
|---|---|---|---|
| Maternal Age (years) | — | — | 27.4 ± 4.9 |
| Maternal Education | Primary | 18 (23.1%) | — |
| | Secondary | 32 (41.0%) | — |
| | Higher | 28 (35.9%) | — |
| Parity | Primiparous | 34 (43.6%) | — |
| | Multiparous | 44 (56.4%) | — |
| Employment Status | Employed | 22 (28.2%) | — |
| | Unemployed | 56 (71.8%) | — |
| Gestational Age at Enrollment (weeks) | — | — | 21.8 ± 3.1 |
| Marital Status | Married | 78 (100%) | — |

**Table 2: Maternal Depression Scores (EPDS) Across Pregnancy**

| Variable | Mean ± SD | Range | n (%) Above Cutoff (≥13) |
|---|---|---|---|
| EPDS Score (Second Trimester) | 10.6 ± 4.1 | 3–21 | 22 (28.2%) |
| EPDS Score (Third Trimester) | 11.4 ± 4.6 | 2–23 | 25 (32.1%) |
| Change in EPDS Score (Second → Third Trimester) | +0.8 ± 2.9 | — | — |

**Table 3: Delivery Outcomes by Maternal Depression Status**

| Outcome | Non-Depressed (n = 53) | Depressed (n = 25) | p-value |
|---|---|---|---|
| Mean Gestational Age at Delivery (weeks) | 38.4 ± 1.6 | 37.6 ± 1.9 | 0.031 |
| Preterm Birth (<37 weeks), n (%) | 5 (9.4%) | 6 (24.0%) | 0.048 |
| Mean Birth Weight (grams) | 2978 ± 368 | 2719 ± 402 | 0.004 |
| Low Birth Weight (<2500 g), n (%) | 6 (11.3%) | 7 (28.0%) | 0.041 |
| Mode of Delivery: Vaginal, n (%) | 36 (67.9%) | 13 (52.0%) | 0.162 |
| Mode of Delivery: Cesarean, n (%) | 17 (32.1%) | 12 (48.0%) | 0.162 |

**Table 4: Neonatal Developmental Milestones at 3 Months (ASQ-3 Domains)**

| ASQ-3 Domain | Non-Depressed Mothers (Mean ± SD) | Depressed Mothers (Mean ± SD) | Mean Difference | p-value |
|---|---|---|---|---|
| Communication | 47.8 ± 6.3 | 43.9 ± 7.1 | 3.9 | 0.012 |
| Gross Motor | 49.5 ± 5.4 | 45.6 ± 6.2 | 3.9 | 0.009 |
| Fine Motor | 46.1 ± 6.8 | 42.3 ± 7.0 | 3.8 | 0.018 |
| Problem Solving | 48.7 ± 6.1 | 44.2 ± 6.5 | 4.5 | 0.006 |
| Personal–Social | 49.2 ± 5.8 | 45.8 ± 6.4 | 3.4 | 0.021 |

**Table 5: Correlation Between Maternal Depression (EPDS) and Infant Outcomes**

| Variable | Pearson r | p-value |
|---|---|---|
| EPDS (3rd Trimester) vs Gestational Age | –0.28 | 0.014 |
| EPDS (3rd Trimester) vs Birth Weight | –0.34 | 0.003 |
| EPDS (3rd Trimester) vs ASQ-3 Communication | –0.31 | 0.008 |
| EPDS (3rd Trimester) vs ASQ-3 Gross Motor | –0.36 | 0.002 |
| EPDS (3rd Trimester) vs ASQ-3 Problem Solving | –0.33 | 0.005 |

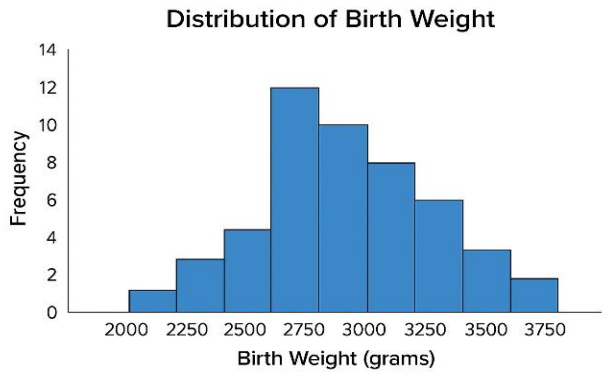


*Figure 2 Distribution of Birth Weight*

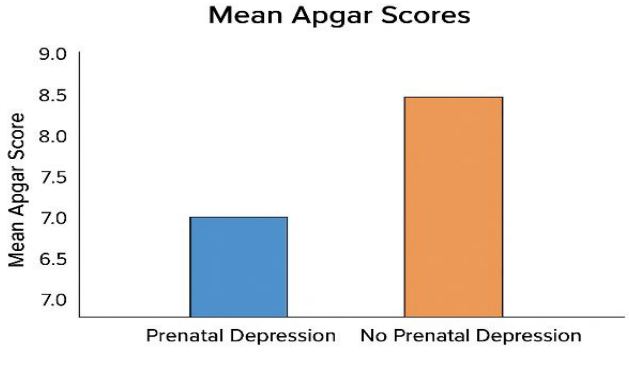


*Figure 2 Mean Apgar Scores*

## DISCUSSION

The present study demonstrated that depressive symptoms during pregnancy were associated with notable differences in both delivery outcomes and early infant development among first-time mothers. Mothers who scored above the threshold for depressive symptoms tended to deliver earlier and had infants with lower birth weights compared with mothers who did not screen positive for depression. Infants born to depressed mothers also exhibited lower developmental scores across communication, gross motor, fine motor, problem-solving, and personal-social domains. These findings reinforce the growing understanding that maternal mental health during pregnancy carries measurable implications for both perinatal and early infant outcomes. The association between prenatal depression and a shorter gestational duration observed in this study aligns with broader evidence suggesting that psychological stress and mood disorders during pregnancy may influence the timing of birth. Although the exact mechanisms were not examined here, pathways such as heightened maternal cortisol levels, altered inflammatory responses, and impaired health-seeking behaviors have been proposed in previous work as contributing factors. Similarly, the observed reduction in birth weight among infants of depressed mothers falls within the range commonly reported across international studies. Even modest reductions in birth weight may have important implications, particularly in settings where socioeconomic or nutritional challenges may compound perinatal vulnerability.

The early developmental findings also warrant careful consideration. Infants of depressed mothers showed consistently lower mean scores across all ASQ-3 domains, indicating potential early neurodevelopmental delays. These differences, although not diagnostic of developmental disorders, may reflect early variations in caregiver–infant interaction quality, maternal responsiveness, or environmental stimulation. Depression can affect maternal engagement, energy levels, and sensitivity to infant cues, which in turn may shape early developmental trajectories. The consistency of lower scores across all domains suggests that the impact of maternal depression is not confined to a single developmental aspect but may influence a broad range of early infant capacities. While the results of this study align with the general direction of existing knowledge, it is important to acknowledge differing findings in the literature. Some studies have reported weaker or no associations between prenatal depression and certain birth outcomes, particularly after adjusting for socioeconomic status, lifestyle factors, and obstetric complications. Variability in findings across studies may reflect differences in population characteristics, cultural factors, screening tools, timing of assessments, or the depth of confounder adjustment. This underscores the complexity of studying mental health during pregnancy and the need for multidimensional approaches that consider biological, psychological, and environmental influences. The strengths of the present study include its focus on first-time mothers, which reduces confounding related to prior obstetric experience, and its use of validated and widely used measurement tools for both maternal mental health and infant development. The study also examined outcomes across both the perinatal and early developmental spectrum, providing a more integrated picture of how prenatal depression may influence maternal and infant wellbeing. Conducting the study in a defined urban setting allowed for controlled data collection and consistent follow-up procedures.

Nevertheless, the study has several limitations that should be acknowledged (1). The cross-sectional design limits the ability to establish causality or determine the direction of associations. Maternal depression was assessed using a screening instrument rather than a diagnostic evaluation, which may have led to misclassification. Data on potential confounding variables—such as maternal nutritional status, family support, stressors unrelated to depression, or pregnancy complications—were not comprehensively captured. The sample size, although adequate for initial analysis, remained relatively small, which limits generalizability and the detection of more subtle associations. Additionally, developmental assessments were limited to early infancy, and long-term developmental outcomes could not be evaluated within the study period. Future research should prioritize longitudinal designs that track maternal mental health from early pregnancy through the postpartum period, coupled with repeated developmental assessments across infancy and early childhood. Including biological markers, such as cortisol or inflammatory profiles, could help elucidate underlying mechanisms. Larger and more diverse samples would improve generalizability and facilitate subgroup analyses. Studies examining the effectiveness of antenatal mental health interventions on improving both maternal mood and infant outcomes would also contribute valuable insight to clinical practice. Overall, the study reinforces the importance of integrating mental health screening into routine antenatal care, particularly for first-time mothers who may be adjusting to new psychological and social demands during pregnancy. Early identification of depressive symptoms and timely intervention may not only improve maternal wellbeing but also promote healthier birth outcomes and more optimal early developmental trajectories for infants.

 

## CONCLUSION

This study found that prenatal depressive symptoms in first-time mothers were associated with shorter gestational duration, lower birth weight, and reduced early developmental scores in infants. These findings highlight the importance of recognizing maternal mental health as a key component of antenatal care. Early screening and supportive interventions during pregnancy may help improve outcomes for both mothers and their infants, reinforcing the value of integrating psychological wellbeing into routine maternal health practices.

### AUTHOR CONTRIBUTION

| Author | Contribution |
|---|---|
| Zarina Naz* | Substantial Contribution to study design, analysis, acquisition of Data<br>Manuscript Writing<br>Has given Final Approval of the version to be published |
| Koukab Abdullah | Substantial Contribution to study design, acquisition and interpretation of Data<br>Critical Review and Manuscript Writing<br>Has given Final Approval of the version to be published |
| Rubina Kousar | Substantial Contribution to acquisition and interpretation of Data<br>Has given Final Approval of the version to be published |
| Fauzia Rafiq | Contributed to Data Collection and Analysis<br>Has given Final Approval of the version to be published |
| Farhat R. Malik* | Contributed to Data Collection and Analysis<br>Has given Final Approval of the version to be published |
| Momtaz Akter Mitu | Substantial Contribution to study design and Data Analysis<br>Has given Final Approval of the version to be published |
| Raiha Fatima | Contributed to study concept and Data collection<br>Has given Final Approval of the version to be published |

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